Researchers' vision: restoring sight through artificial retinas

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Scientists are testing artificial retinas that they hope can restore partial sight to people who've lost their vision to the most common causes of blindness.

Retinitis pigmentosa, which ruins peripheral vision, and macular degeneration, which causes a blurred or blind spot in central vision, affect millions of people, especially the elderly.

Both diseases irreparably damage the retina, the light-sensitive patch at the back of the eye that converts images into signals and relays them the brain.

The government-sponsored researchers' goal is to create sensitive devices that can be implanted in the eye and will let previously blind people recognize faces and read large print.

"Retinal prostheses represent the best near-term hope for individuals with incurable, blinding diseases of the outer retina," said Dr. Mark Humayun, a surgeon at the Doheny Eye Institute at the University of Southern California, Los Angeles, who's implanted artificial retinas in patients.

Tests of a relatively crude artificial retina began on six patients in 2002. With the aid of these devices, people who'd been totally blind were able to read foot-high letters, tell a plate from a cup, find doors and windows, and navigate around large objects, according to Brian Mech, vice

president of Second Sight Medical Products.

The Sylmar, Calif., company produced the devices for the U.S. Energy Department's Artificial Retina Project. The department has been engaged in biological research since the atomic bomb tests of the 1950s raised fears of radiation poisoning.

This first-generation eye implant, named Argus One, consisted of a tiny camera mounted on a pair of dark glasses and a hip-mounted microprocessor. The bionic gadget relayed images to a silicon chip containing an array of 16 electrodes - conductors of electrical signals - that was surgically attached to the front of the retina. The electrodes created a 4 by 4 pattern of light and dark spots in the visual processing center at the back of the brain.

At first, patients saw only scattered bits a light. With this scant information, plus weeks or months of retraining, however, they learned to make out straight lines, distinguish light areas from dark ones and detect motion. The training was necessary because the brain loses its ability to interpret sight after long disuse.

One retinitis pigmentosa patient, identified as Linda, could shoot a basketball through a hoop and tell which way the offense was moving on a TV screen, Mech said.

Another patient, Terry, spotted the shadow of his 18 year-old son as he passed by on a sidewalk. "It was the first time I'd seen anything of him since he was 5 years old," Terry told Artificial Retina News, a publication of the Artificial Retina Project.

Argus One is still in use, but it's being succeeded by Argus Two, a smaller, more sophisticated device with an array of 60 electrodes, providing a much sharper image to its users.

The newer device is being tested on 17 blind people in the U.S. and Europe, and more patients are being enrolled. At a retina conference in October, patients reported improvements in orientation and mobility. They were able to find a door from 20 feet away and to follow a line on the floor for 20 feet, Mech reported.

Meanwhile, researchers in the Energy Department's National Laboratories are creating a third-generation artificial retina. Much smaller than its predecessors, the device will contain 200 or more electrodes on a thin, flexible film that curves to fit the shape of the retina. Human tests are scheduled to begin in 2011.

"We're aiming for a 1,000-electrode array," said Ray Orbach, the department's undersecretary for science. Such a device would "let a blind patient recognize objects and read large-scale newsprint," Orbach told a scientific conference in early December.

Artificial retinas are still experimental and won't be available for commercial use for years. The devices will cost at least $30,000, Mech said, and many technical problems remain.

Still, scientists are optimistic about the future of artificial retinas.

"It's exciting to know that one day blind people won't be stuck with darkness," said Terry, who's still using his early model Argus One.

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Artificial Retina Project: artificialretina.energy.gov

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